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Dr. Gustafson
MATH 361 HW Ch. 3.1

✓ ✓ ✓
1a, 5a, 7a

Problem 1

$$F(x) = \cos(x)$$

a.)

x	f(x)
0	1.000000000
0.6	0.8253356149
0.9	0.6216099683

$$P_2(x) = \frac{(x-0.6)(x-0.9)}{(0-0.6)(0-0.9)}(1.0) + \frac{(x-0)(x-0.9)}{(0.6-0)(0.6-0.9)}(0.8253356149) + \frac{(x-0)(x-0.6)}{(0.9-0)(0.9-0.6)}(0.6216099683)$$

$$P_2(0.45) = 0.8981000747 \qquad \therefore \ f'''(x) = \sin(x)$$

$$\frac{f'''(\xi(x))}{3!}|(x-x_0)(x-x_1)(x-x_2)| \leq \left| \frac{\sin(\xi(x))}{6}(0.45-0)(0.45-0.6)(0.45-0.9) \right|$$

$$\leq \left| \frac{\sin(0.9)}{6}(0.45)(-0.15)(-0.45) \right| \leq 0.0039655925$$

$$\boxed{P_2(0.45) = 0.8981000747 \pm 0.0039655925}$$

a.)

x	f(x)
8.1	16.94410
8.3	17.56492
8.6	18.50515
8.7	18.82091

$$P_3(x) = \frac{(x-8.3)(x-8.6)(x-8.7)}{(8.1-8.3)(8.1-8.6)(8.1-8.7)}(16.94410) + \frac{(x-8.1)(x-8.6)(x-8.7)}{(8.3-8.1)(8.3-8.6)(8.3-8.7)}(17.56492)$$

$$+ \frac{(x-8.1)(x-8.3)(x-8.7)}{(8.6-8.1)(8.6-8.3)(8.6-8.7)}(18.50515) + \frac{(x-8.1)(x-8.3)(x-8.6)}{(8.7-8.1)(8.7-8.3)(8.7-8.6)}(18.82091)$$

$$\boxed{P_3(8.4) = 17.8789425}$$

a.) $f(x) = x \ln(x)$

x	f(x)
8.1	16.94410
8.3	17.56492
8.6	18.50915
8.7	18.82091

$f'(x) = \ln(x) + 1$, $f''(x) = \dfrac{1}{x}$, $f'''(x) = \dfrac{-1}{x^2}$, $f^4(x) = \dfrac{2}{x^3}$

$\dfrac{f^4(5(x)) \ (x-8.1)(x-8.3)(x-8.6)(x-8.7)}{4!}$

$\dfrac{1}{24} \cdot \dfrac{2}{(5(x))^3} \cdot (x-8.1)(x-8.3)(x-8.6)(x-8.7) \longrightarrow 5(x) \longrightarrow 8.1$

$\left| \dfrac{1}{24} \cdot \dfrac{2}{(8.1)^3} \cdot (8.4-8.1)(8.4-8.3)(8.4-8.6)(8.4-8.7) \right| \leq 2.822514635 \times 10^{-7}$

$\boxed{2.822514635 \times 10^{-7}}$